Academic Performance in Double-Shift Schooling

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Abstract

Many developing countries with constrained resources have adopted the double-shift schooling system as a way to serve more students. However, there is some concern that some students may be hurt by these policies. With a unique dataset from Mexico's National Institute for Educational Assessment and Evaluation (INEE), I apply Heckman′s selection model to measure the effects of individual, teacher, and school characteristics on student test scores and estimate the difference in academic performance of students in morning and afternoon school sessions. While I find a statistically significant effect of being in the morning shift, the Oaxaca decomposition shows that this effect can be explained by the observed difference in characteristics of students from two shifts. The results show that self-selection of students to schooling sessions explains the apparent academic inequality between students from different sessions.

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I. Introduction

Double-shift or double-session schooling is a schooling system in which different cohorts of students use the same building and have the same academic curriculum, some in the mornings and some in the afternoons. Many developing countries, including Mexico, India, Brazil, Zimbabwe, Russia, Bulgaria, have adopted the double-shift schooling system. In the United States, in states such as Florida, a double-shift system is maintained due to the occurrence of natural disasters affecting the physical conditions of existing school buildings. In general, the purpose of double-shift schooling is to increase access to schooling while limiting strain on the budget.

From the policy perspective the introduction of double shifts allows existing sets of buildings and facilities to serve more students. This may be especially important in urban areas, where land is scarce and construction of new buildings is expensive. Double-shift schooling has helped many countries to move toward universal primary and secondary education. However, this policy may come at a cost. The limited school day under the multiple shift operation leaves few or no opportunities for any extra-curricular activities. In addition, there is some concern that students may be hurt by such policy. Afternoon students may receive a poorer education because of their tiredness by the time of classes or the diminishing productivity of teachers. The purpose of this study is to determine whether the difference in academic performance of students in the morning and afternoon shifts has a causal nature or is due to differences in characteristics of students as a result of the selection process.

Using a unique dataset from Mexico′s National Institute for Educational Assessment and Evaluation (INEE: *Instituto Nacional para la Evaluación de la Educación*), I examine factors influencing academic performance of students from different school shifts. More specifically, I focus on ninth grade students of secondary schools from morning and afternoon shifts and examine the effects of socio-economic and academic variables on students test score performance. To control for selection bias I employ the Heckman two-stage model. My key identification for the selection equations comes from exclusion restriction in which variable restricting school capacity determines the probability of a student getting into the morning session but not their performance on the tests. Furthermore, I apply the Oaxaca wage gap decomposition method to decompose the total effect into the effects of observed characteristics, returns to characteristics, and selection. In addition, I extend the analysis by decomposing the test difference due to observable characteristics into the three parts: due to the student, teacher, and school characteristics.

The results of my study reveal that there is no causal effect of the morning shift on the academic inequality of students from different shifts. Most of the test score difference can be explained by differences in the characteristics of students. The results also suggest that half of the math test score

gap is due to differences in the observed characteristics of teachers. The findings of my research contribute an argument to the debate addressing the advantages and disadvantages of the double-shift schooling system. My results suggest that the double-shift schooling in Mexico serves its purpose by providing the equal education opportunities to all students.

II. Background and Literature Overview

Double-shift schooling (DSS) has been implemented in Mexico since the 1970s as a strategy to achieve universal access to basic education, given the lack of resources to fund construction of additional new school buildings. In this way the Mexican government has increased utilization of existing infrastructure by introducing morning, afternoon, and evening school shifts. Moreover, teachers have been given the opportunity to hold two teaching positions, thereby increasing their salaries. However, when schools reach their full capacity and begin to operate in two or three shifts, schools move away from learning communities where students spend longer periods of time and engage in extended sessions or extracurricular activities. In addition, the DSS system can create academic inequality between students from different shifts. In comparisons of means students from the morning shift perform better than students from the later shifts. The potential explanations for this difference in academic performance include less productive and/or less qualified teachers, tired and less attentive students, or negative peer effects in the afternoon shift.

Teachers often want to work to raise their earnings by working in more than one session, which may affect teacher instruction or teacher productivity. Educators in Mexico have been known as ″taxi teachers″ because many teachers jump into taxis at the end of the morning session in order to rush to teach an afternoon session elsewhere if they are not allowed to teach an additional session at the same school. One implication of ″shift work″ by many teachers is that they may be less effective educators in the afternoon. Unlike many professions where an individual worker performs a certain task or a few tasks during working hours, teachers must work outside their teaching hours without extra compensation. Teachers perform multiple tasks requiring specialization in areas such as educating students, monitoring student performance, and student discipline. In addition, many duties, such as preparing lesson plans, assignments, and grading, are performed outside the school and after working hours. Furthermore, teachers are generally required to teach more than one subject. Given the multiple tasks performed by a teacher, teacher performance may not be constant over the school day, the semester, or even the entire school year. As a result, a teacher's diminishing effectiveness in the classroom may affect students′ performance.

Students who attend the afternoon session spend their mornings studying, or performing house chores, or working to supplement family income. In rural areas, children generally help their families in field work. As a result, children attending afternoon school sessions may be at a disadvantage

because they are tired and they may be less attentive to new learning.

Because of the perceived difference in academic performance between the different schooling shifts, goal-oriented parents and students seek the highest quality of education may prefer to attend the morning school session. However, the morning school sessions cannot accommodate all children. As a result selection decisions are made by the school administration. In general, student applicants with higher test scores in earlier year at their elementary schools are given higher priority for placement into the morning shift. Therefore, the test scores of students from the afternoon shifts, on average, are lower than the test scores of students from the morning shifts.

The literature on double-shift schooling is presented mostly by education practitioners. Existing works focus on the issues, problems, and benefits of the multiple shift schooling system. For example, Brey (2008) provides an overview of double-shift systems for students, teachers and school administrators. More specifically, Linden (2001) examines secondary schools that teach two sets of students in two shifts and concludes that double-shift schools appear to offer an adequate education and a solution for countries with resource constraints seeking to expand their secondary education systems.

Educational researchers in Mexico have turned their attention to the problems with DSS implementation. By analyzing differences in students′ and teachers′ distributions of characteristics, Cárdenas (2010) found that, on average, afternoon shift schools have lower levels of educational quality. His research shows that schools in the afternoon session have a higher proportion of low-income students and higher failure and dropout rates in comparison to morning shift schools sharing the same facilities. Saucedo Ramos (2005) describes a selection process which intentionally places repeaters and students with discipline problems into the afternoon session and shows that quality of instruction is lower in the afternoon than in the morning shift because of the different expectations and attitudes of teachers and principals. Using aggregate school data, Treviño Villarreal and Treviño González (2004) find the Spanish scores of afternoon cohort students are significantly lower than the scores of morning shift students. Moreover, they show the importance of positive attitudes of teachers on the academic performance of students.

The literature on educators focuses on observable teacher characteristics such as experience, education, and certification. Santibañez (2006) indicates teacher test scores have a small positive relationship with average student achievement scores, although the effect is larger in secondary schools than in primary schools. Rivkin, Hanushek, and Kain (2005) find teachers in their first or second years of teaching are associated with lower student test scores in Texas, but teacher education and certification have no systematic relationship to student test score achievement. Betts, Zau, and Rice (2003) find mixed results for teacher characteristics using detailed individual-level data from

elementary schools in the San Diego Unified School District. Rockoff (2004) shows teacher quality, measured by teacher fixed effects, have an important impact on student achievement. In other words, teacher quality may be important for students'performance; however, teacher productivity may be a detriment to students'performance when teachers work extended hours.

III. Education System in Mexico

According to the Constitution of Mexico, the objective of Mexican public education is compulsory education free of charge for every child. Since the Mexican Revolution of 1917, the basic goal of the government has been to increase educational coverage. Today, the Mexican education system serves over 30 million students and employs 1.6 million teachers in more than 229,000 schools and basic education enrollment has more than doubled from 9.7 million students in 1970 to 21.6 million students in 2000 (Razquin, Santibañez , Vernez (2005)). This rapid growth in basic education demand is primarily met by double shifting of schools and flexibility of teacher employment practices.

The Mexican education system is organized into four levels: preschool (K1–K3), compulsory basic education (grades 1–9), which includes primary and lower secondary education, upper secondary education (grades 10–12), and higher education. The government is officially responsible for providing compulsory basic education. The education system of Mexico also allows for the existence of private schools, but the public school system serves almost 90 percent of all students in the country. The delivery of basic education in Mexico takes different forms. However, ninety-three percent of primary education is delivered by general modality, a traditional approach that employs the Ministry of Education pre-approved universal national curriculum.

The Ministry of Education of Mexico (SEP: *Secretaría de Educación Pública*) is responsible for the country′s educational system; which includes setting guidelines for teacher salaries, along with the academic calendar year and the length of the school day. Specifically, all teachers are required to follow SEP′s national curriculum. Primary schools must use national textbooks, while secondary schools must choose textbooks from a nationally approved list. The school calendar generally is set to 200 days, beginning in August and ending in June of each calendar year. SEP specifies the length of each school day to four hours, allowing primary schools to operate regular sessions in multiple shifts: morning, afternoon, and sometimes evening. On the other hand, lower secondary schools operate in the mornings and afternoons, and each shift meets for five hours. In each regular shift, one-hour subjects include Spanish, mathematics, natural sciences, and social sciences. The consequences of operating multiple shifts and a limited school day leave few or no opportunities to study music or participate in extra-curricular activities such as sports, although some schools do make time for these subjects.

IV. Identification Strategy

A. Main Model Framework

To identify factors that influence the academic performance of students, this study employs a model developed by Nakosteen and Zimmer (1980) to estimate migration decisions, using Heckman's (1979) two-stage estimation technique for sample selection bias. Specifically, the students in the sample are categorized into one of these two mutually exclusive regimes, with the selection equation serving as an endogenous selection criterion which determines the student′s shift.

Unlike the Nakosteen and Zimmer model, in which the migration decision is voluntary and based on an implicit cost-benefit analysis, this study's sorting function between morning and afternoon shifts involves both the choice of a student and the decision of the school administration. For simplicity, the analysis assumes every child (or their parents) prefers the morning shift, *ceteris parabus*. Although this assumption might not be completely true and there may be students who prefer the afternoon shift, the assumption is close to reality. One the instances of these reasons is the working schedule of parents. However, the fact that on average morning session grades are higher than afternoon grades makes the morning shift more desirable for students. In addition, the quality of teaching may be better in the morning, because teachers may not yet be tired, and therefore more effective in their teaching. As a result, excess demand for and limited capacity in the morning shift force students who cannot get into the morning cohort to be enrolled in the afternoon session. In fact, the unbalanced cohort size in the data reflects this situation.

Formally, at the beginning of middle school, student i wants to get into the morning shift if

$$S_i(M_i|X_i) - S_i(A_i|X_i) > F_i,$$

where $S(\cdot)$ is the score function of a student's family, representing the utility of schooling, M is an indicator variable that equals 1 if student i is in the morning shift and 0 otherwise, $A = 1 - M$, and X represents student, teacher, and school characteristics. The function F represents opportunity costs of the morning shift as a difference in expected scores. Furthermore, this function, which is assumed to be linear and additive, can be expressed as a function of characteristics, X, and an error term, v:

$$F_i = f(X_i) + v_i \tag{1}$$

Though the capacity for both shifts is the same when both shifts use the same schooling facilities, the school selection process in the morning session fills up to full capacity. Therefore, the enrollment in the morning shift, E_m, is equal to the full capacity of the school and the enrollment in the afternoon shift, E_a is less than or equal to the maximum capacity of the school. Since school

capacity is different across schools, the ratio of morning to afternoon enrollment represents the degree to which capacity is constrained for the morning session. In other words, $W = \frac{E_m}{E_a}$ given the observed school characteristics should determine the probability that a student is admitted to the morning session. The sorting function can be modeled as

$$Prob(M_i = 1|X_i, W_i) = \Phi(Z_i'\gamma) \tag{2}$$

where $W_i \geq 1$ and $Z_i = (X_i, W_i)$.

Given the selection mechanism for students into the morning shift, the sorting equation is the function of gains in shifts′ scores and student, teacher, and school characteristics. Specifically, student i, with the vector of explanatory variables and excluded variables in the vector Z_i gets into the morning shift if

$$M_i^* > 0$$

and the afternoon shift if

$$M_i^* \leq 0$$

where

$$M_i^* = \alpha_0 + \alpha_1(S_{mi} - S_{ai}) + Z_i'\alpha_2 - \epsilon_i \tag{3}$$

The model is completed by the test score equations for morning and afternoon students as follows:

$$S_{mi} = X_{mi}'\beta_m + u_{mi} \tag{4}$$

$$S_{ai} = X_{ai}'\beta_a + u_{ai}, \tag{5}$$

where S_m and S_a are the performance scores for morning and afternoon students. The unobserved error terms ϵ is assumed to be a standard normal variable and u_m, u_a are unobserved error terms with means 0 and variances σ_m^2 and σ_a^2. In addition, the disturbance terms in equations (**??**), (**??**), and (**??**) are assumed to be jointly normally distributed with zero means and nonzero correlation between ϵ and u_m, ϵ and u_a.

We observe an indicator variable for the morning shift, defined as $M = 1$ if $M_i^* > 0$ and $M = 0$ if $M_i^* \leq 0$. In addition, we observe the scores for students in this certain shift, or $S = S_m$ when $M_i = 1$ and $S = S_a$ when $M_i = 0$.

Substituting equations (4) and (5) into equation (3) yields a reduced form of the sorting equation:

$$M_i^* = \gamma_0 + Z_i'\gamma_1 - \nu_i \tag{6}$$

where Z is the vector consisting of all exogenous variables in the model for both groups of students. Assuming that ν is normally distributed with mean zero and unit variance, the sorting equation above is estimated by the probit model.

Then, if we define $\psi_i = \gamma_0 + Z_i'\gamma_1$, the conditional means of the score disturbance terms do not equal zero, but vary with each observation, and differ for the morning and the afternoon cohort:

$$E(u_{mi}|M_i = 1) = \rho_{u_m\epsilon}\sigma_{u_m}\Big[\frac{-\phi(\psi)}{\Phi(\psi)}\Big] \tag{7}$$

$$E(u_{ai}|M_i = 0) = \rho_{u_a\epsilon}\sigma_{u_a}\Big[\frac{\phi(\psi)}{1-\Phi(\psi)}\Big], \tag{8}$$

where $\rho_u\epsilon$ is the correlation between morning or afternoon respective u and ϵ, σ_{um} and σ_{ua} are the standard deviations of the disturbance terms of the two main score equations, and $\phi(\cdot)$ and $\Phi(\cdot)$ are the standard normal density and cumulative distribution functions, respectively.

B. Estimation Technique

The estimation of the score equations employs the ″Heckman Two-Step″ methodology. The first step runs a probit regression of the reduced form sorting equation (6) using all observations from both morning and afternoon shifts. The estimate of γ from the probit estimation is then used to obtain fitted values of $\hat{\psi}_i$ to construct consistent estimates of the Inverse Mills Ratio (IMR) for the morning shift

$$\hat{\lambda}_{mi} = \Big[\frac{-\phi(\hat{\psi}_i)}{\Phi(\hat{\psi}_i)}\Big]$$

and afternoon shift

$$\hat{\lambda}_{ai} = \Big[\frac{\phi(\hat{\psi}_i)}{1-\Phi(\hat{\psi}_i)}\Big]$$

.

In the second stage, the outcome equations, including the IMR variable, are estimated by OLS technique, where the score equations are:

$$S_{mi} = X_{mi}'\beta_m + \theta_m\hat{\lambda}_{mi} + \eta_{mi} \tag{9}$$

$$S_{ai} = X_{ai}'\beta_a + \theta_a\hat{\lambda}_{ai} + \eta_{ai} \tag{10}$$

C. Test Score Gap Decomposition

Heckman′s two-stage estimation technique consistently estimates the parameters of the score equations. The unbiased estimators of the score equations can further be used to estimate the average expected score difference across students in different shifts. However, even after the selection bias

correction, the average test score difference cannot explain the reasons why this difference still exists. The selection process allows us to see that on average the morning student is endowed with better characteristics. This might create unobservable peer effects. On the other hand, it is possible that differences in teacher characteristics can reinforce the positive effect of the academically advanced morning students or that the effect night be negated by the effect of bigger classes. In order to identify the nature of the test score gap I apply the methodology of Neuman and Oaxaca (2004) to the difference in expected test scores from different sessions.

The difference in expected values of test scores of the morning and afternoon shifts for a students i is:

$$\begin{aligned}\tau_i &= E(S_{mi}|X_{mi}, W_i, M_i = 1) - E(S_{ai}|X_{ai}, W_i, M_i = 0) \\ &= [X'_{mi}\beta_m + \theta_m\hat{\lambda}_{mi}] - [X'_{ai}\beta_a + \theta_a\hat{\lambda}_{ai}]\end{aligned}$$

Then the estimate of the overall difference in expected scores of different shifts, $\hat{\tau}$, is

$$\hat{\tau} = \frac{1}{n}\sum_{i=1}^{n}\hat{\tau}_i = (\overline{X}'_m\hat{\beta}_m - \overline{X}'_a\hat{\beta}_a) + (\hat{\theta}_m\overline{\hat{\lambda}}_m - \hat{\theta}_a\overline{\hat{\lambda}}_a) \tag{11}$$

where $\overline{X}$ is the mean vector of score determining the variables including a constant term, $\hat{\beta}$ is the vector of the estimated returns to the score determinants, $\hat{\theta}$ is the estimate of $\rho_{u\epsilon}\sigma_u$, and $\overline{\hat{\lambda}}$ is the mean of the Inverse Mills Ration estimated from the first stage of the selection equation.

Furthermore, the decomposition technique identifies the difference in the average scores between sessions due to the difference in characteristics, or explained gap, due to the returns to characteristics of students, teachers, and schools, or unexplained, and due to the selection process.

$$\hat{\tau} = \underbrace{(\overline{X}_m - \overline{X}_a)'\hat{\beta}_a}_{\text{explained gap}} + \underbrace{\overline{X}'_m(\hat{\beta_m} - \hat{\beta}_a)}_{\text{unexplained gap}} + \underbrace{(\hat{\theta}_m\overline{\hat{\lambda}}_m - \hat{\theta}_a\overline{\hat{\lambda}}_a)}_{\text{gap due to the selection}} \tag{12}$$

The explained gap, or the difference in expected score due to the difference in observed characteristics, can be further decomposed into the difference due to the students, teachers, and school characteristics.

$$\begin{aligned}(\overline{X}_m - \overline{X}_a)'\hat{\beta}_a = &(\overline{X}_{m,student} - \overline{X}_{a,student})'\hat{\beta}_{a,student} \\ &+ (\overline{X}_{m,teacher} - \overline{X}_{a,teacher})'\hat{\beta}_{a,teacher} \\ &+ (\overline{X}_{m,school} - \overline{X}_{a,school})'\hat{\beta}_{a,school}\end{aligned}$$

Such fine decomposition can explain the exact source of the the difference in score gap if any.

V. Data Description

This paper employs the INEE dataset of standardized tests, administered by the SEP of Mexico to assess the general level of knowledge of students in both public and private schools throughout the country. The INEE was created by a presidential mandate on August 8th, 2002 as an independent organization to monitor and to assess the quality of the National Educational System.

The INEE collects information and conducts surveys to evaluate the students educational achievement and the general quality level of schools. The INEE collaborates with the The Organization for Economic Co-operation and Development (OECD) in the Programme for International Student Assessment (PISA) since 2000 and with the United National Educational, Scientific and Cultural Organization (UNESCO) in Second Regional Comparative and Explanatory Study (SERCE) since 2006. For the national education evaluation, the INEE developed Reviews of Quality and Educational Achievement (EXCALE: *Exámenes de la Calidad y el Logro Educativos*) in 2004.

The paper employs EXCALE–09. EXCALE–09 are datafiles containing a representative sample of ninth graders from lower secondary schools at the end of the 2007-2008 school year. The ninth grade signifies the last year for compulsory education; thereafter students have the option either to continue their education at the high school level or to end their schooling and enter the labor market.

The INEE administers paper-and-pencil tests to all ninth-grade students. The test format combines multiple-choice and open-ended questions. The test results are normalized and between 200 and 800. In addition to student test results, the INEE conducts survey questionnaires on personal characteristics with students, teachers, and school principals. Each student, teacher, and school is assigned a unique identifying code in the EXCALE dataset. Using these identifying codes I merge student test scores with their survey questionnaires. Personal student questionnaire contains many questions which allows me to pick a number of student characteristics to identify the parameters of their test score equations and control for the self selection as well as the identifying code of the school the student is in. Specifically, student characteristics include a student′s gender, age, parentsíncome, whether she lives with one or both parents, educational level of the student's parents and their occupational category, average number of hours a week the student spends studying outside of school, and whether the student is required with house chores.

Datasets containing the questionnaire answers of teachers and school principals have the school code that allows me to merge these datasets with the student information. The rich questionnaires allow me to handpick the teacher variables, such as her age, education level, and experience, the total number of hours the teacher works at a given school, whether she teaches one subject or more, and whether she teaches another shift or is employed outside of education.

Variables capturing the average number of hours a week a student spends helping her family, a dummy variable for whether a teacher teaches another shift or has another job. This variable may reveal whether a teacher teaching an additional shift diminishes teacher productivity and, thus, may be less effective as a teacher. In addition,when a child spends time helping the family it may cause a student to be fatigue and, thus, less attentive in the classroom.

The variables determining the probability that a student gets into the morning shift is the relative constraining capacity of the morning shift school, $\frac{E_m}{E_a}$. Since the number of students applying to the morning shift exceeds the capacity of the morning session, morning session enrollment must be higher than afternoon shift enrollment. The Ministry of Education statistical data support this fact. On average, the ratio of urban school morning shift enrollment to afternoon enrollment sharing the same facilities is 2.18 with a standard deviation of 1.63.

The enrollment data for each school and other variable describing school characteristics are available in the principal′s questionnaire. Each different shift is assigned a unique, untraceable identification number. In other words, two different shifts sharing the same school building have two different identification numbers. As a result, it is not possible to identify in the INEE data whether two shifts are using the same school building. Using the publicly available data on Mexican schools I constructed a variable for constraining capacity of the morning shift, W_i. Upon special request, the research office of the INEE matched this variable to each school shift sharing the same building.

The excluded variable W for student i captures the morning shift enrollment constraint of a student's school relative to the afternoon shift enrollment. In other words, for the morning session students, the probability of getting into the morning shift increases in W_{ism}, holding everything else constant. Similarly, for students in the afternoon session, the exclusion restriction W_{isa} decreases in their school enrollment relative to the average morning enrollment. So, the probability of getting into the morning shift increases in W_{isa}. These excluded variables do not directly correlate with the academic performance of students. The school size and number of schools in the area depend on the local government budget and are therefore exogenous in the model. However, there may be worries that the shift enrollment correlates with the test scores, the outcome variable, through the class size or school quality. For instance, Angrist and Lavy (1999) find reducing class size induces an increase in test scores for fourth and fifth graders. Card and Krueger (1992) suggest reduction in the student-teacher ratio for elementary school students results in an increase in test scores on reading and math exams. Hence, school enrollment might be large or small, but potential success in a course strongly depends on the number of students in a class, or the teacher-student ratio. In order to control this potential correlation, a class size variable as a part of teacher questionnaire is

included as a control variable in the analysis.

Other variables determining the school quality, such as the numbers of books and computers in the school, the existence of violence activity in the vicinity of the school, whether a school equipped for disabled students, if there is sport facility in a school, and if a school in the urban area are also included in the estimation. Therefore, holding school quality constant, the excluded variable W can serve as the determinant for sorting students into shifts.

The process of merging multiple datasets identified matching codes for only math and Spanish reading comprehension scores. The final samples for the analysis includes only students from public schools of general modality using double-shift system. Therefore, the compiled dataset for this study includes final math score sample of 2,579 students and the final Spanish score sample of 2,532 students with 1,367 and 1,308 students in the morning shift, respectively.

Summary statistics are reported in Tables **1** and **2**. Since the data comes from the survey questionnaire the answers are categorical. Most of categorical answers are not linear in their values. In order to avoid any measurement errors and censoring problems in the analysis all variables are converted into the set of indicator variables. The first four columns of the table show the mean and the standard deviation of variables for morning and afternoon sessions. The last column reports the t-values for the test if the variables′ means of two groups of students are equal. The t-statistics show that most characteristics of morning group of students are very different from the characteristic of afternoon students. Specifically, morning students have higher average test score both in math and Spanish. They are younger than afternoon students which shows that there are more repeaters in the afternoon session who are less likely to get into the morning shift. Students from the morning shift come from the wealthier families and whose parents are more educated and work in the more professional positions. We can also see that morning classes are bigger on average and have more experienced teacher. Although, the summary statistics also shows that morning teachers are more likely to teach another shift and work more hours.

VI. Regression Results

The first stage of the Heckman procedure involves estimation of a probit equation, where the dependent variable takes on the value 1 if the student is in the morning session and 0 if the student is in the afternoon session. Table **3** presents the results of this estimation on the math and Spanish samples respectively. The parameter of the constraining capacity of the morning school is positive and statistically significant for mathematics and Spanish scores. This implies the probability of getting into the morning shift increases with the increase in the constraining enrollment of a school, conditioning on a student and school characteristics. The sign of this excluded variable is as predicted by the model. In addition, the Chi-square test from the probit estimation indicates the assignment

of students into various schooling shifts is not random. The estimates from the probit regressions are used to construct the Inverse Mills Ratio (IMR) to correct for selection bias in the estimation of the score equations.

Tables **4** and **5** report the estimated score equations on math and Spanish samples respectively. The first two columns present the results of the least square regressions, and other two columns present the results of the regressions with selectivity correction. Although, the coefficients on the IMR are not statistically significant the IMR still takes care of the selection into the shifts.

A number of the estimated coefficients on the variables of some categories that explain scores for the difference between two schooling shifts are not statistically significant. However a teacher teaching another shift has a positive effect on the math scores of students. This variable has less positive effect on the Spanish performance and the result is statistically significant only for morning session students. The sign of this variable is not as it was expected. This might be explained by the fact that a teacher teaching another shift gets a chance to practice his lecture more and presents it better. Interestingly, the teacher's hours of work has a negative effect on afternoon student's math score. This might be an evidence of the teacher$'$ diminishing productivity. However, the variable for a teacher working more than 35 hours a week has a positive influence on Spanish scores. A student spending more than three hours a week helping around the house has lower Math and Spanish scores in the afternoon shift although the effect is not statistically significant. Math score is higher for a students spending more time studying at home. Moreover, the magnitude for morning students is larger than for afternoon students. The same variable has also a positive effect on the Spanish score of students studying more hours a day, but the effect is larger for afternoon students.

The coefficient of the dummy variable for male students is positive and statistically significant in the Math equation and negative and statistically significant in the Spanish equation. This indicates that boys perform better in mathematics tests while girls perform better on tests of literacy and writing, which is consistent with the literature. Zembar and Blume (2009) show girls, on average, are better at spelling than boys and perform better on tests involving literacy, writing, and general knowledge, while boys, on average, perform better on mathematics tests in fourth grade.

Although no direct measure of a student family income exists in the dataset, a proxy variable is generated from the number of light bulbs and availability of internet access. Specifically, Sathaye and Meyers (1985) argue that wealthy families in developing countries live in larger homes and demand greater lighting of their houses than low-income households. In this study the number of light bulbs in a house, is positive and statistically significant for the families with 10 light bulbs and higher in a house, which is generally consistent with the results of other studies revealing the positive relationship between income and academic performance. The age of student coefficient is negative

and statistically significant for the students in the afternoon shift, which indicates that students older than average ninth grader perform worse. Also, considering the selection process of students into the shifts, repeaters, or students older than their peers, are more likely to be in the afternoon shift. Therefore, the student's age has such a negative impact on the academic performance in the afternoon session.

Davis-Kean (2005) establishes a relationship between parents′ educational attainment and children′ academic achievement through parents′ educational expectations and parent-specific behaviors. My results show that mother's education has positive and statistically significant effect on academic performance of students rather than father's education. There is more effect of mother's education on math scores of morning students while there is no evidence of the effect on afternoon shift students. On the other hand, Spanish scores are positively related with the education of a mother in both shifts, although the magnitude of the effect is higher for morning students.

Larger class size has a more negative impact on math test performance than on Spanish. This may be explained by the difference in the nature of two subjects: math needs more concentration and individual approach which is less possible in beggar classes. Card and Krueger (1992) also show rate of returns to education are higher for individuals from states with better-educated teachers and with a higher fraction of female teachers. Although a number of studies show mixed results from a teacher′s experience on a student′s achievement scores, the less experienced teachers in this study show a positive effect on afternoon students′ performance in Spanish and negative effect on morning students′ performance in math.

The predicted total average score gap along with its decomposition are presented in Tables **6** and **7**. The left panels of each table show the decomposition of the effect of the morning shift using a simple OLS specification. Uncorrected for selection, results show the average difference between morning and afternoon students. On average, morning students score about 42 points higher on math and about 46 points higher on Spanish reading comprehension tests which roughly translates to about 8 percent of the mean morning score. The decomposition results imply that not all of the difference is due to the unobserved effect of the school shift. More than a half of the score gap is explained by the differences in the observed characteristics of students, teachers, and schools. Moreover, the further decomposition of the explained gap shows us that the statistically significant effect is due to the difference in students and teachers variables.

The right panel of both tables presents the decomposition results corrected for the selection. Even though the results show students on average do better in the morning session than in the afternoon, the difference due to the returns to characteristics is not statistically different from zero. In other words, there is no evidence that the academic performance of students would be better in

the morning school if students were randomly assigned to the different shifts. The implication is that most of the positive effect of going to the morning session may be due to the fact that better students get to the morning shift due to the assignment process. Most of this effect come from the difference in the observed characteristics, specifically from the characteristics of students. Of the total math score difference, about 17 points, or 3 percent of the mean morning math score can be explained by the difference in the characteristics of teachers, while Spanish scores do not depend on teacher characteristics. Math is the harder subject to teach and this may explain the greater importance of teacher. In both subjects the selection component of the test score gap is positive, although is not statistically significant.

The results indicate that if there were no difference in the characteristics of the average student from the morning and afternoon shifts, there would be no statistically significant effect of the morning shift. That is, the non-random assignment of the students into the shifts may be the reason of the apparent academic inequality between these two group of students. However, if the students were to be assigned to the shifts randomly, the difference between two schooling shift my be eliminated

VII. Conclusion

The double-shift schooling system has been widely used to expand student enrollments and thereby to achieve the objective of ″Education for All.″ Despite the advantages of the double-shift schooling system, there may be negative externalities in academic achievement between the students from different schooling sessions. For instance, teacher effectiveness may decrease in the afternoon shift; which may lead to a reduction in the quality of teaching. In addition, students′ concentration may be lower in the afternoon, which in turn may affect the ability to learn new material and, thus, result in lower academic performance by students in the afternoon shift.

This paper examines the double-shift schooling system in Mexico, where the school administration assigns children to the different schooling sessions. The non-random assignment of children to different schooling shifts results in differences in the performance score gap between students in the morning and in the afternoon shifts. As a result, high ability students are granted admission into the morning shift, while low ability students are assigned to the afternoon session. As a result, these factors could result in an unequal distribution of educational opportunities across different groups of students.

This study analyzes academic performance of students from different schooling shifts using the Heckman selection model. The findings show a teacher working more hours yields a negative effect on students performance in both shifts. In addition, student studying is positive and statistically significant in the morning shift. However, most of the effect of the morning shift on academic

achievement is due to the difference in the characteristics of students. In other words, the random assignment of students to the different schooling sessions may help to eliminate apparent average difference in the performance scores.

The importance of this research contributes to the debate of public policies and, moreover, the ways that government institutions address the consequences of the double-shift schooling system. In the case of Mexico, the double-shift schooling provides a solution to issues related to scarce resources and infrastructure limitations without creating inequalities in the quality of the education students receive between the two sessions.

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IX. Tables

Table 1: **Summary Statistics for Math Score Sample**

	Morning Shift		Afternoon Shift		Difference
Variable	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**	**in Means**
Relative Capacity	2.086	1.552	1.948	1.261	0.1381***
Student's Characteristics					
Average Math Score	524.553	94.535	482.630	80.834	41.9232***
Male	0.445	0.497	0.479	0.500	-0.0346*
Student's Age	15.147	0.464	15.460	0.697	-0.3129***
BothParents	0.793	0.405	0.762	0.426	0.0314**
Hours of Study:					
Not studying	0.020	0.139	0.029	0.168	-0.0091*
1 hour or less	0.298	0.457	0.376	0.485	-0.0785***
2 hours	0.391	0.488	0.357	0.479	0.0341*
3 hours	0.217	0.413	0.177	0.382	0.0399**
4 hours and more	0.074	0.262	0.060	0.238	0.0137
Hours of Help:					
Not helping	0.033	0.178	0.034	0.181	-0.0009
Less than 1 hour	0.137	0.344	0.128	0.334	0.0089
1 to 2 hours	0.429	0.495	0.389	0.488	0.0401**
3 hours and more	0.402	0.490	0.450	0.498	-0.0481**
Mother's education:					
No education	0.009	0.093	0.025	0.155	-0.0160***
1-3 grades	0.098	0.297	0.176	0.381	-0.0777***
3-6 grades	0.125	0.331	0.179	0.384	-0.0540***
7-9 grades	0.329	0.470	0.361	0.481	-0.0322
10-12 grades	0.243	0.429	0.182	0.386	0.0613***
Bachelor Degree	0.146	0.353	0.061	0.240	0.0845***
Graduate Degree	0.050	0.219	0.017	0.127	0.0340***
Father's education:					
No education	0.023	0.149	0.033	0.179	-0.0103
1-3 grades	0.085	0.279	0.158	0.365	-0.0736***
3-6 grades	0.101	0.301	0.145	0.352	-0.0443***
7-9 grades	0.274	0.446	0.324	0.468	-0.0507**
10-12 grades	0.257	0.437	0.209	0.407	0.0488***
Bachelor Degree	0.171	0.377	0.101	0.302	0.0697***
Graduate Degree	0.089	0.285	0.029	0.168	0.0604***
Mother's ocupation:					
Not working	0.588	0.492	0.693	0.461	-0.1049***
Elementary occupation	0.048	0.214	0.060	0.238	-0.0120
Worker	0.023	0.151	0.037	0.189	-0.0137

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(*continued*)

Table **1**: **Summary Statistics for Math Score Sample**

	Morning Shift		Afternoon Shift		Difference
Variable	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**	**in Means**
Service employee	0.031	0.173	0.031	0.172	0.0002
Service provider	0.089	0.284	0.091	0.287	-0.0022
Clerical support worker	0.096	0.294	0.043	0.203	0.0529***
Associate professional	0.008	0.089	0.008	0.090	-0.0002
Professional	0.108	0.310	0.032	0.177	0.0754***
Manager	0.010	0.097	0.005	0.070	0.0046*
Father′s ocupation:					
Not working	0.023	0.149	0.043	0.203	-0.0202***
Elementary occupation	0.185	0.389	0.269	0.444	-0.0839***
Worker	0.162	0.369	0.197	0.398	-0.0348**
Service employee	0.164	0.370	0.164	0.371	-0.0003
Service provider	0.137	0.344	0.125	0.331	0.0114
Clerical support worker	0.082	0.274	0.059	0.236	0.0225**
Associate professional	0.049	0.216	0.059	0.236	-0.0104
Professional	0.175	0.380	0.065	0.247	0.1097***
Manager	0.023	0.151	0.017	0.131	0.0061
Number of Light Bulbs in the house:					
0-3	0.050	0.217	0.073	0.261	-0.0237***
4-5	0.120	0.325	0.198	0.399	-0.0780***
6-7	0.181	0.385	0.224	0.417	-0.0437***
8-9	0.209	0.407	0.209	0.407	0.0005
10-15	0.261	0.439	0.194	0.396	0.0673***
16-25	0.119	0.324	0.074	0.262	0.0450***
26 and more	0.060	0.238	0.027	0.163	0.0328***
Internet	0.371	0.483	0.225	0.418	0.1456***
Teacher′s Characteristics					
Class Size:					
41 students and more	0.285	0.452	0.141	0.348	0.1442 ***
26-41 students	0.675	0.468	0.600	0.490	0.0754 ***
16-25 students	0.029	0.167	0.235	0.424	-0.2066***
15 students and less	0.011	0.104	0.024	0.153	-0.0130**
Experience:					
Less than 2 years	0.018	0.134	0.062	0.241	-0.0436***
3-10 years	0.196	0.397	0.304	0.460	-0.1076***
11-15 years	0.206	0.405	0.165	0.371	0.0413 **
16 years and more	0.579	0.494	0.469	0.499	0.1099 ***
Hours of work:					

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(*continued*)

Table **1**: **Summary Statistics for Math Score Sample**

	Morning Shift		Afternoon Shift		Difference
Variable	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**	**in Means**
5 hours and less	0.025	0.156	0.076	0.265	-0.0510***
6-16 hours	0.112	0.315	0.185	0.388	-0.0729***
17-34 hours	0.304	0.460	0.376	0.485	-0.0719***
35 hours and more	0.559	0.497	0.363	0.481	0.1959 ***
Age:					
29 and younger	0.050	0.217	0.125	0.331	-0.0757***
30-39 years	0.229	0.420	0.244	0.430	-0.0153
40-49 years	0.421	0.494	0.450	0.498	-0.0283
50 and older	0.300	0.458	0.181	0.385	0.1192***
Teaching 1 subject	0.797	0.402	0.766	0.424	0.0317
College degree	0.206	0.405	0.178	0.383	0.0281
Additional Shift	0.282	0.450	0.232	0.422	0.0505***
Has Another Job	0.901	0.299	0.885	0.319	0.0152
School Characteristics					
Violence in vicinity	0.458	0.498	0.468	0.499	-0.0099
Number of Books:					
100 and less	0.045	0.207	0.111	0.315	-0.0668***
100-200	0.094	0.291	0.125	0.331	-0.0318***
200-400	0.176	0.381	0.184	0.388	-0.0084
400 and more	0.686	0.464	0.579	0.494	0.1070***
Number of Computers:					
No computers	0.090	0.286	0.090	0.286	0.00004
10 and less	0.154	0.361	0.186	0.390	-0.0321***
11-30	0.556	0.497	0.530	0.499	0.0263
31-50	0.103	0.304	0.126	0.332	-0.0231
50 and more	0.097	0.295	0.068	0.251	0.0289***
Disability Facility	0.143	0.351	0.125	0.330	0.0188**
Sport Facility	0.876	0.330	0.865	0.342	0.0110
Urban	0.977	0.151	0.965	0.183	0.0112
N	1,367		1,212		

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table **2**: **Summary Statistics for Spanish Score Sample**

	Morning Shift		Afternoon Shift		Difference
Variable	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**	**in Means**
Relative Capacity	2.005	1.478	2.015	1.330	-0.0098
Student's Characteristics					
Average Spanish Score	525.264	92.461	479.536	86.314	45.7273 ***
Male	0.438	0.496	0.513	0.500	-0.0750***
Student's Age	15.157	0.474	15.456	0.704	-0.2991***
BothParents	0.818	0.386	0.740	0.439	0.0778***
Hours of Study:					
Not studying	0.013	0.113	0.028	0.164	-0.0148***
1 hour or less	0.320	0.466	0.378	0.485	-0.058***
2 hours	0.367	0.482	0.385	0.487	-0.0178
3 hours	0.199	0.399	0.158	0.365	0.0411***
4 hours and more	0.102	0.302	0.051	0.221	0.0502 ***
Hours of Help:					
Not helping	0.042	0.201	0.038	0.190	0.0045
Less than 1 hour	0.144	0.352	0.132	0.339	0.0121
1 to 2 hours	0.454	0.498	0.404	0.491	0.0497**
3 hours and more	0.359	0.480	0.426	0.495	-0.0663
Mother's education:					
No education	0.011	0.103	0.036	0.186	-0.0252***
1-3 grades	0.091	0.288	0.174	0.379	-0.0830***
3-6 grades	0.136	0.343	0.194	0.396	-0.0584***
7-9 grades	0.297	0.457	0.349	0.477	-0.0522***
10-12 grades	0.264	0.441	0.154	0.361	0.1102***
Bachelor Degree	0.151	0.359	0.064	0.244	0.0877***
Graduate Degree	0.050	0.219	0.029	0.169	0.0210***
Father's education:					
No education	0.015	0.120	0.027	0.162	-0.0124**
1-3 grades	0.081	0.273	0.126	0.332	-0.0448***
3-6 grades	0.109	0.312	0.175	0.380	-0.0655***
7-9 grades	0.291	0.455	0.349	0.477	-0.0576***
10-12 grades	0.232	0.423	0.203	0.403	0.0290*
Bachelor Degree	0.206	0.405	0.088	0.284	0.1182***
Graduate Degree	0.065	0.247	0.032	0.176	0.0331***
Mother's ocupation:					
Not working	0.609	0.488	0.690	0.463	-0.0802***
Elementary occupation	0.044	0.206	0.058	0.234	-0.0137
Worker	0.025	0.157	0.037	0.188	-0.0115*
Service employee	0.022	0.147	0.051	0.219	-0.0285***
Service provider	0.083	0.275	0.071	0.257	0.0115
Clerical support worker	0.099	0.298	0.051	0.221	0.0472***

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(*continued*)

Table **2**: **Summary Statistics for Spanish Score Sample**

	Morning Shift		Afternoon Shift		Difference
Variable	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**	**in Means**
Associate professional	0.005	0.073	0.007	0.085	-0.0020
Professional	0.103	0.304	0.033	0.178	0.0705***
Manager	0.009	0.095	0.002	0.049	0.0067**
Father′s ocupation:					
Not working	0.025	0.157	0.038	0.192	-0.0132*
Elementary occupation	0.158	0.365	0.264	0.441	-0.1056***
Worker	0.163	0.369	0.206	0.405	-0.0430***
Service employee	0.184	0.388	0.207	0.405	-0.0224
Service provider	0.146	0.353	0.113	0.316	0.0333**
Clerical support worker	0.080	0.271	0.045	0.207	0.0346***
Associate professional	0.060	0.237	0.049	0.216	0.0106
Professional	0.163	0.369	0.060	0.238	0.1024***
Manager	0.021	0.145	0.018	0.133	0.0034
Number of Light Bulbs in the house:					
0-3	0.037	0.190	0.079	0.270	-0.0418***
4-5	0.122	0.327	0.192	0.394	-0.0704***
6-7	0.170	0.376	0.246	0.431	-0.0754***
8-9	0.214	0.410	0.197	0.398	0.0172
10-15	0.288	0.453	0.181	0.385	0.1077***
16-25	0.125	0.331	0.073	0.260	0.0527***
26 and more	0.043	0.203	0.033	0.178	0.0101
Internet	0.364	0.481	0.203	0.402	0.1613***
Teacher′s Characteristics					
Class Size:					
41 students and more	0.319	0.466	0.109	0.311	0.2101***
26-41 students	0.652	0.476	0.632	0.483	0.0206
16-25 students	0.018	0.131	0.237	0.425	-0.2193***
15 students and less	0.011	0.107	0.023	0.150	-0.0114**
Experience:					
Less than 2 years	0.035	0.184	0.057	0.232	-0.0220***
3-10 years	0.198	0.399	0.237	0.425	-0.0389**
11-15 years	0.196	0.397	0.176	0.381	0.0200
16 years and more	0.570	0.495	0.529	0.499	0.0409**
Hours of work:					
5 hours and less	0.063	0.244	0.114	0.318	-0.0509***
6-16 hours	0.148	0.355	0.184	0.387	-0.0363**
17-34 hours	0.318	0.466	0.377	0.485	-0.0594***
35 hours and more	0.471	0.499	0.324	0.468	0.1466***
Age:					

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(*continued*)

Table **2**: **Summary Statistics for Spanish Score Sample**

	Morning Shift		Afternoon Shift		Difference
Variable	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**	**in Means**
29 and younger	0.079	0.269	0.089	0.285	-0.0103
30-39 years	0.213	0.409	0.223	0.416	-0.0105
40-49 years	0.507	0.500	0.447	0.497	0.0600***
50 and older	0.202	0.402	0.241	0.428	-0.0392**
Teaching 1 subject	0.864	0.343	0.815	0.389	0.0494***
College degree	0.147	0.354	0.123	0.329	0.0234*
Additional Shift	0.285	0.452	0.270	0.444	0.0147
Has Another Job	0.957	0.203	0.906	0.292	0.0511***
School Characteristics					
Violence in vicinity	0.497	0.500	0.477	0.500	0.0198
Number of Books:					
100 and less	0.047	0.213	0.115	0.319	-0.0678***
100-200	0.102	0.302	0.122	0.327	-0.0201
200-400	0.177	0.381	0.177	0.382	-0.0007
400 and more	0.674	0.469	0.586	0.493	0.0885***
Number of Computers:					
No computers	0.089	0.284	0.102	0.303	-0.0134
10 and less	0.167	0.373	0.195	0.397	-0.0286*
11-30	0.528	0.499	0.511	0.500	0.0169
31-50	0.115	0.319	0.124	0.330	-0.0095
50 and more	0.102	0.303	0.068	0.252	0.0346***
Disability Facility	0.153	0.360	0.132	0.338	0.0214
Sport Facility	0.846	0.361	0.862	0.345	-0.0156
Urban	0.976	0.152	0.958	0.200	0.0180**
N	1,308		1,224		

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table **3**: **First Stage Probit Estimates**

	Math Sample		**Spanish Sample**	
	Coefficient	**Std. Error**	**Coefficient**	**Std. Error**
Relative Capacity	0.1621***	0.0588	0.1243**	0.0557
Student's Characteristics				
Male	-0.0583	0.0580	-0.1665***	0.0468
Student's Age	-0.4528***	0.0668	-0.3882***	0.0587
BothParents	0.1314	0.0824	0.3223***	0.0965
Hours of Study:				
1 hour or less	0.2462	0.1702	0.3577*	0.2170
2 hours	0.4040**	0.1682	0.4457**	0.2105
3 hours	0.4522**	0.1831	0.6126**	0.2452
4 hours and more	0.4626**	0.1891	0.8887***	0.2429
Hours of Help:				
Less than 1 hour	-0.0302	0.1585	-0.0621	0.1704
1 to 2 hours	-0.0262	0.1678	-0.1460	0.1536
3 hours and more	-0.1056	0.1692	-0.2281	0.1668
Mother's education:				
1-3 grades	0.3402	0.2815	0.3066	0.2326
3-6 grades	0.3426	0.2939	0.5161**	0.2316
7-9 grades	0.4091	0.2983	0.4920**	0.2477
10-12 grades	0.4609	0.2932	0.7639***	0.2459
Bachelor Degree	0.6125**	0.2954	0.7452***	0.2427
Graduate Degree	0.6190*	0.3273	0.3833	0.3417
Father's education:				
1-3 grades	-0.3272	0.2242	-0.0793	0.2690
3-6 grades	-0.2299	0.1969	-0.2011	0.2746
7-9 grades	-0.1796	0.1896	-0.0855	0.2446
10-12 grades	-0.1906	0.1885	-0.1236	0.2475
Bachelor Degree	-0.2732	0.1885	-0.0660	0.3025
Graduate Degree	-0.1249	0.2387	-0.1732	0.3391
Mother's ocupation:				
Elementary occupation	0.1726	0.1471	0.0757	0.1237
Worker	-0.1625	0.2016	-0.0034	0.1937
Service employee	0.1072	0.2030	-0.3342**	0.1355
Service provider	-0.0167	0.1237	-0.0136	0.1190
Clerical support worker	0.4666***	0.1354	0.2385*	0.1360
Associate professional	-0.0772	0.2641	-0.5686	0.3461

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(*continued*)

Table **3**: **First Stage Probit Estimates**

	Math Sample		**Spanish Sample**	
	Coefficient	**Std. Error**	**Coefficient**	**Std. Error**
Professional	0.2416	0.1843	0.3271**	0.1471
Manager	0.0588	0.4167	0.7634	0.5350
Father′s ocupation:				
Elementary occupation	0.1475	0.1476	-0.0179	0.1542
Worker	0.1353	0.1554	-0.0001	0.1718
Service employee	0.2817*	0.1585	0.0601	0.1601
Service provider	0.2379	0.1517	0.1372	0.1482
Clerical support worker	0.2097	0.1879	0.2339	0.2370
Associate professional	0.0053	0.1757	0.1566	0.2071
Professional	0.4965***	0.1886	0.3836	0.2554
Manager	0.3979	0.2475	0.0829	0.3446
Number of Light Bulbs in the house:				
4-5	-0.0786	0.1390	-0.0667	0.1665
6-7	-0.0580	0.1547	-0.1073	0.1324
8-9	0.0535	0.1330	0.0336	0.1531
10-15	0.1171	0.1431	0.2153	0.1600
16-25	0.0593	0.1635	0.0980	0.2093
26 and more	0.2983	0.2229	-0.1289	0.2446
Internet	0.1376	0.0928	0.1251	0.0868
Teacher′s Characteristics				
Class Size:				
26-41 students	-0.4137**	0.2025	-0.6458***	0.2129
16-25 students	-1.7917***	0.3620	-2.1497***	0.3813
15 students and less	-0.8389	0.6487	-0.9653	0.6662
Experience:				
3-10 years	-0.0272	0.3869	-0.0090	0.5030
11-15 years	0.2763	0.3945	0.0235	0.5342
16 years and more	0.1518	0.4250	0.0394	0.5484
Hours of work:				
6-16 hours	0.4975*	0.2901	0.1759	0.3424
17-34 hours	0.5851**	0.2721	0.2070	0.3356
35 hours and more	0.8621***	0.2536	0.3460	0.3204
Age:				

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(*continued*)

Table **3**: **First Stage Probit Estimates**

	Math Sample		**Spanish Sample**	
	Coefficient	**Std. Error**	**Coefficient**	**Std. Error**
30-39 years	0.4816	0.3133	0.0344	0.3491
40-49 years	0.3155	0.3509	0.1665	0.3426
50 and older	0.6205	0.4037	-0.1146	0.3779
Teaching 1 subject	0.1598	0.1711	0.1646	0.2531
College degree	0.0440	0.2151	0.3256	0.2100
Additional Shift	0.3352*	0.1995	0.1369	0.1869
Has Another Job	0.2067	0.2324	0.3596	0.3094
School Characteristics				
Violence in vicinity	-0.0627	0.1617	0.1503	0.1534
Number of Books:				
100-200	0.5291	0.4136	0.6132	0.4917
200-400	0.5944*	0.3130	0.5812	0.3982
400 and more	0.6561**	0.3058	0.5539	0.3920
Number of Computers:				
10 and less	-0.0924	0.3505	0.2150	0.3475
11-30	0.0392	0.3042	0.2296	0.3448
31-50	-0.2144	0.3780	-0.0747	0.3629
50 and more	-0.1390	0.4124	0.0937	0.4758
Disability Facility	-0.1196	0.2701	-0.1875	0.2595
Sport Facility	0.0014	0.3242	-0.1037	0.2649
Urban	0.1857	0.4614	0.4515	0.5130
Constant	3.9371***	1.4920	3.3374**	1.5735
N	2,579		2,532	
Presudo R^2	0.247		0.257	

Standard errors are bootstrapped and clustered at school level.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table **4**: **Regression Results of Average Math Test Scores**

Variable	**OLS**		**Heckman Estimation**	
	Morning Shift	**Afternoon Shift**	**Morning Shift**	**Afternoon Shift**
Student's Characteristics				
Male	13.356***	8.595*	12.580**	8.919*
	(5.068)	(4.608)	(5.209)	(4.716)
Student's Age	-1.792	-15.726***	-6.989	-13.078***
	(5.394)	(3.333)	(8.718)	(4.709)
BothParents	3.551	15.310***	4.800	13.990**
	(6.219)	(5.467)	(7.123)	(4.930)
Hours of Study:				
1 hour or less	28.772	8.125	31.357*	6.870
	(18.274)	(13.674)	(17.351)	(13.513)
2 hours	53.342***	23.251*	57.900***	20.704
	(5.936)	(5.111)	(17.762)	(13.582)
3 hours	56.653***	44.685***	61.486***	42.041***
	(6.125)	(5.905)	(19.081)	(13.744)
4 hours and more	77.518***	16.497	82.308***	13.490
	(9.444)	(9.456)	(20.034)	(16.126)
Hours of Help:				
Less than 1 hour	46.836***	-7.676	46.822***	-6.807
	(15.018)	(13.495)	(11.963)	(12.987)
1 to 2 hours	27.550*	6.990	27.457*	7.693
	(7.056)	(6.632)	(10.090)	(12.273)
3 hours and more	26.149*	-2.510	25.177*	-0.982
	(5.078)	(4.512)	(10.324)	(12.287)
Mother's education:				
1-3 grades	45.643	11.238	50.553*	8.924
	(28.685)	(15.314)	(27.120)	(18.180)
3-6 grades	44.616	10.188	49.771*	8.022
	(10.501)	(7.412)	(27.008)	(18.655)
7-9 grades	43.359	9.998	49.762*	7.565
	(6.876)	(5.478)	(26.987)	(18.019)
10-12 grades	53.763*	25.207	60.691**	22.182
	(6.647)	(6.385)	(27.706)	(19.122)
Bachelor Degree	76.439***	31.764*	84.974***	27.370
	(8.496)	(10.534)	(29.287)	(21.033)
Graduate Degree	55.236*	14.662	63.299**	10.112
	(13.672)	(20.578)	(33.655)	(28.669)
Father's education:				
1-3 grades	7.636	1.176	3.104	3.512
	(18.341)	(13.365)	(20.430)	(12.361)
3-6 grades	2.963	5.487	-0.419	6.541
	(10.681)	(7.724)	(18.783)	(12.990)
7-9 grades	17.050	-3.402	14.322	-2.306
	(7.254)	(5.530)	(17.921)	(12.390)
10-12 grades	29.874	2.831	27.218	3.792
	(6.365)	(5.798)	(18.286)	(13.201)

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Table 4: **Regression Results of Average Math Test Scores**

Variable	**OLS**		**Heckman Estimation**	
	Morning Shift	**Afternoon Shift**	**Morning Shift**	**Afternoon Shift**
Bachelor Degree	35.197*	10.472	31.716	12.013
	(8.348)	(8.623)	(20.614)	(15.028)
Graduate Degree	18.368	-1.571	16.326	-1.331
	(9.839)	(14.133)	(21.660)	(24.790)
Mother′s ocupation:				
Elementary occupation	15.092	4.713	16.970	3.151
	(11.794)	(9.444)	(14.266)	(8.223)
Worker	13.299	19.294	11.426	20.101*
	(16.352)	(11.801)	(19.648)	(12.288)
Service employee	17.639	12.708	17.787	11.941
	(14.335)	(12.855)	(14.127)	(14.528)
Service provider	19.347**	23.156***	18.567**	23.073***
	(9.046)	(7.901)	(10.502)	(9.137)
Clerical support worker	-0.672	20.837*	3.995	17.429
	(8.447)	(11.060)	(10.569)	(12.732)
Associate professional	-16.322	-9.101	-17.960	-8.429
	(27.306)	(24.838)	(29.468)	(26.870)
Professional	-8.968	6.897	-7.351	4.318
	(8.858)	(12.849)	(12.386)	(16.560)
Manager	-25.718	18.606	-24.277	16.216
	(25.424)	(33.396)	(23.809)	(26.510)
Father′s ocupation:				
Elementary occupation	-14.806	-15.808	-12.960	-16.568
	(17.124)	(11.409)	(23.432)	(12.092)
Worker	-16.253	1.039	-14.701	0.480
	(8.111)	(6.419)	(23.089)	(12.212)
Service employee	-16.672	-22.192*	-13.837	-23.661*
	(7.283)	(6.258)	(23.306)	(11.745)
Service provider	-14.898	-13.946	-12.392	-15.290
	(7.593)	(6.864)	(24.692)	(13.558)
Clerical support worker	-19.327	-0.927	-16.844	-1.806
	(9.146)	(9.435)	(24.006)	(15.733)
Associate professional	-47.299**	-25.468*	-48.009**	-25.107*
	(11.406)	(9.392)	(24.567)	(15.524)
Professional	3.799	-23.759	8.673	-27.137*
	(6.775)	(9.021)	(25.213)	(17.617)
Manager	-21.667	-27.619	-17.802	-29.436
	(16.270)	(16.871)	(28.303)	(28.710)
Number of Light Bulbs in the house:				
4-5	-7.407	9.850	-8.226	9.983
	(12.953)	(9.500)	(12.346)	(8.133)
6-7	12.484	14.786	12.157	14.994
	(8.319)	(6.276)	(11.490)	(8.468)
8-9	11.169	5.022	12.032	4.602

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(*continued*)

Table 4: **Regression Results of Average Math Test Scores**

Variable	**OLS**		**Heckman Estimation**	
	Morning Shift	**Afternoon Shift**	**Morning Shift**	**Afternoon Shift**
	(6.790)	(5.773)	(11.831)	(8.381)
10-15	26.491**	24.693**	28.079**	23.718**
	(5.889)	(5.728)	(11.960)	(9.729)
16-25	8.776	32.522***	10.087	31.933***
	(7.654)	(8.576)	(12.877)	(12.341)
26 and more	3.927	19.440	7.325	17.277
	(10.481)	(13.710)	(15.499)	(16.920)
Internet	-2.208	-0.211	-0.866	-1.400
	(5.101)	(5.277)	(6.388)	(5.918)
Teacher's Characteristics				
Class Size:				
26-41 students	-10.383*	-20.927***	-13.678**	-18.052**
	(5.939)	(6.820)	(10.417)	(13.205)
16-25 students	-47.995***	-21.916***	-70.935***	-11.652
	(15.361)	(5.555)	(38.366)	(18.464)
15 students and less	-26.324	-39.946**	-34.588	-34.559**
	(25.121)	(14.579)	(27.616)	(26.351)
Experience:				
3-10 years	-38.857*	12.559	-37.159*	12.373
	(20.563)	(10.331)	(32.562)	(11.974)
11-15 years	-38.118*	20.364*	-31.971	18.315
	(8.464)	(7.391)	(34.162)	(14.370)
16 years and more	-35.642	15.238	-31.668	14.140
	(6.883)	(5.999)	(34.159)	(13.647)
Hours of work:				
6-16 hours	8.713	-14.775	16.179	-17.206*
	(17.462)	(9.672)	(26.011)	(11.201)
17-34 hours	7.126	-18.796**	15.385	-21.344**
	(8.099)	(5.834)	(24.217)	(11.508)
35 hours and more	3.505	-13.418	14.378	-18.442*
	(5.279)	(4.960)	(25.616)	(12.298)
Age:				
30-39 years	14.932	-5.175	20.949	-8.849
	(12.701)	(8.015)	(27.233)	(12.586)
40-49 years	16.315	4.020	20.853	1.248
	(6.140)	(4.955)	(27.319)	(12.567)
50 and older	17.555	4.636	25.644	-0.558
	(5.659)	(5.766)	(29.594)	(15.498)
Teaching 1 subject	3.916	-2.059	5.664	-3.126
	(6.211)	(5.526)	(9.424)	(7.801)
College degree	0.513	-0.904	1.275	-1.882
	(6.149)	(5.712)	(9.635)	(7.656)
Additional Shift	10.881*	16.214***	14.992**	14.184**

Continued on next page

(*continued*)

Table 4: **Regression Results of Average Math Test Scores**

Variable	**OLS**		**Heckman Estimation**	
	Morning Shift	**Afternoon Shift**	**Morning Shift**	**Afternoon Shift**
	(5.563)	(5.314)	(10.936)	(8.565)
Has Another Job	-7.829	-7.337	-6.728	-8.895
	(8.285)	(6.970)	(14.808)	(9.100)
School Characteristics				
Violence in vicinity	-12.629**	-1.858	-13.289**	-1.198
	(4.893)	(4.448)	(7.580)	(6.193)
Number of Books:				
100-200	-10.956	16.307*	-4.630	13.676
	(14.940)	(9.044)	(23.745)	(17.378)
200-400	-39.342***	-2.161	-30.921*	-5.306
	(9.120)	(6.929)	(24.173)	(15.588)
400 and more	-15.647	5.895	-7.054	2.712
	(5.522)	(4.539)	(23.104)	(14.670)
Number of Computers:				
10 and less	-10.627	-45.601***	-11.811	-45.306***
	(10.129)	(8.886)	(16.920)	(15.650)
11-30	2.351	-29.533***	2.125	-29.671***
	(5.948)	(5.176)	(15.591)	(14.050)
31-50	-11.303	-33.162***	-15.187	-31.512***
	(8.031)	(6.615)	(19.961)	(17.941)
50 and more	19.102	-25.696**	16.688	-24.264**
	(8.160)	(8.816)	(21.564)	(20.708)
Disability Facility	-4.526	-12.180*	-5.291	-11.417
	(6.960)	(6.580)	(11.476)	(11.112)
Sport Facility	3.959	14.091**	4.613	13.654*
	(7.305)	(6.328)	(12.181)	(10.892)
Urban	-11.156	-18.686	-8.576	-18.976
	(15.915)	(11.829)	(33.698)	(18.184)
Inverse Mills Ratio			-23.013	13.756
			(27.239)	(16.993)
Constant	452.462***	723.186***	476.723***	687.201***
	(2.406)	(2.164)	(117.567)	(88.548)
N	1,367	,1212	1,367	1,212
Presudo R^2	0.161	0.183	0.162	0.184

Standard errors in parentheses are bootstrapped and clustered at school level.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table **5**: **Regression Results of Average Spanish Test Scores**

Variable	**OLS**		**Heckman Estimation**	
	Morning Shift	**Afternoon Shift**	**Morning Shift**	**Afternoon Shift**
Student's Characteristics				
Male	-27.980***	-25.899***	-30.830***	-27.561***
	(4.899)	(4.735)	(5.122)	(5.267)
Student's Age	-12.382**	-13.211***	-20.064***	-17.051***
	(5.152)	(3.339)	(7.703)	(4.528)
BothParents	-0.817	-13.598**	4.452	-10.459*
	(6.443)	(5.457)	(7.981)	(6.636)
Hours of Study:				
1 hour or less	-12.519	16.379	-5.741	20.853
	(21.865)	(14.367)	(22.127)	(16.285)
2 hours	16.962	25.560*	24.878	31.008**
	(5.814)	(5.200)	(21.822)	(16.917)
3 hours	13.787	31.275**	24.594	38.814**
	(6.098)	(6.426)	(22.649)	(17.894)
4 hours and more	28.242	55.800***	43.329*	66.696***
	(8.035)	(10.422)	(24.352)	(21.414)
Hours of Help:				
Less than 1 hour	30.670**	9.343	30.055**	9.018
	(13.215)	(13.427)	(14.472)	(14.491)
1 to 2 hours	17.001	9.906	15.205	8.427
	(6.525)	(6.629)	(13.077)	(13.921)
3 hours and more	6.008	-3.587	2.450	-6.352
	(5.043)	(4.639)	(13.537)	(13.423)
Mother's education:				
1-3 grades	57.466**	17.011	68.337***	19.534
	(25.480)	(13.321)	(24.328)	(13.990)
3-6 grades	65.666**	23.915*	79.879***	28.485**
	(9.967)	(7.246)	(24.460)	(14.454)
7-9 grades	64.528**	11.406	78.548***	15.661
	(7.021)	(5.569)	(24.256)	(13.986)
10-12 grades	75.244***	27.990*	93.920***	35.852**
	(6.315)	(6.987)	(25.820)	(16.209)
Bachelor Degree	71.972***	30.965*	90.453***	38.438**
	(8.091)	(10.596)	(27.110)	(19.066)
Graduate Degree	43.082	-17.252	57.323*	-13.777
	(13.248)	(15.536)	(27.560)	(23.094)
Father's education:				
1-3 grades	6.028	-12.590	2.149	-12.704
	(21.415)	(15.205)	(23.946)	(13.376)
3-6 grades	9.152	-17.638	2.982	-19.265
	(10.454)	(8.062)	(25.016)	(13.621)
7-9 grades	13.109	-7.638	9.363	-8.102
	(7.016)	(5.660)	(22.648)	(12.913)
10-12 grades	24.683	-2.711	20.695	-3.665
	(6.218)	(6.082)	(24.044)	(13.871)

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(*continued*)

Table **5**: **Regression Results of Average Spanish Test Scores**

Variable	**OLS**		**Heckman Estimation**	
	Morning Shift	**Afternoon Shift**	**Morning Shift**	**Afternoon Shift**
Bachelor Degree	45.049*	-1.604	41.807*	-1.170
	(7.637)	(9.995)	(24.678)	(16.505)
Graduate Degree	42.756*	21.447	38.469	20.310
	(10.853)	(14.748)	(26.945)	(24.352)
Mother′s ocupation:				
Elementary occupation	4.605	38.793***	6.104	40.419***
	(11.705)	(9.829)	(10.164)	(9.971)
Worker	-2.666	3.184	-3.981	2.950
	(15.213)	(12.248)	(13.506)	(15.595)
Service employee	17.718	17.348	9.486	13.905
	(16.205)	(10.566)	(15.937)	(10.558)
Service provider	4.081	28.094***	3.216	27.548***
	(8.925)	(9.100)	(9.363)	(8.793)
Clerical support worker	24.112***	17.803	27.301***	20.750*
	(8.359)	(10.500)	(8.854)	(12.360)
Associate professional	20.167	16.385	7.558	9.287
	(32.497)	(26.914)	(46.615)	(27.681)
Professional	3.191	9.098	6.568	13.690
	(8.397)	(13.189)	(11.670)	(16.691)
Manager	-37.969	-91.565*	-26.564	-79.671*
	(25.017)	(46.242)	(23.899)	(55.113)
Father′s ocupation:				
Elementary occupation	13.856	25.277**	12.747	26.173**
	(15.869)	(12.404)	(15.538)	(11.571)
Worker	32.853**	39.605***	31.968**	40.472***
	(8.076)	(6.513)	(15.555)	(13.042)
Service employee	18.071	25.522*	18.325	26.841**
	(6.803)	(5.975)	(15.237)	(12.736)
Service provider	25.833	30.515**	27.463*	32.946**
	(7.108)	(7.362)	(15.354)	(13.329)
Clerical support worker	17.377	23.549	20.936	26.706
	(8.967)	(11.178)	(15.652)	(16.733)
Associate professional	-3.874	21.827	-2.428	24.237
	(10.121)	(10.559)	(16.004)	(15.048)
Professional	29.892*	32.922*	34.385*	37.364**
	(6.706)	(9.697)	(16.423)	(20.340)
Manager	-13.790	-25.992	-12.688	-25.448
	(16.297)	(17.206)	(21.090)	(19.229)
Number of Light Bulbs in the house:				
4-5	10.888	8.952	8.983	7.892
	(13.874)	(9.598)	(14.303)	(9.637)
6-7	13.378	17.228*	10.653	15.719
	(8.199)	(6.339)	(13.753)	(9.932)
8-9	15.346	12.272	15.434	12.563

Continued on next page

(*continued*)

Table **5**: **Regression Results of Average Spanish Test Scores**

Variable	**OLS**		**Heckman Estimation**	
	Morning Shift	**Afternoon Shift**	**Morning Shift**	**Afternoon Shift**
	(6.538)	(6.092)	(13.445)	(9.688)
10-15	20.320	21.240**	23.410*	23.150**
	(5.577)	(6.044)	(14.316)	(10.890)
16-25	37.074**	30.504**	37.988**	30.785**
	(7.309)	(8.867)	(15.361)	(12.893)
26 and more	28.022	17.533	24.941	15.308
	(11.735)	(12.935)	(18.761)	(16.918)
Internet	-2.061	6.216	0.704	8.164
	(4.920)	(5.703)	(6.037)	(6.903)
Teacher's Characteristics				
Class Size:				
26-41 students	-8.727	-8.085	-18.264**	-16.827
	(5.460)	(7.741)	(10.363)	(15.985)
16-25 students	25.095	-8.005	-23.802	-29.259
	(18.784)	(5.594)	(47.656)	(24.006)
15 students and less	-11.630	-32.049*	-30.769	-43.892**
	(22.728)	(15.493)	(27.018)	(35.285)
Experience:				
3-10 years	12.928	31.291**	11.971	31.550**
	(13.851)	(12.113)	(15.276)	(16.620)
11-15 years	0.087	14.687	0.430	14.961
	(7.704)	(7.714)	(15.734)	(18.759)
16 years and more	21.019	14.435	20.749	15.334
	(6.310)	(5.674)	(14.460)	(17.646)
Hours of work:				
6-16 hours	13.995	14.015	17.101	16.075*
	(11.275)	(8.823)	(14.901)	(11.990)
17-34 hours	3.661	-1.829	8.984	0.977
	(6.881)	(6.072)	(13.971)	(11.651)
35 hours and more	20.425*	12.658	26.863**	17.144*
	(5.243)	(5.159)	(14.287)	(12.755)
Age:				
30-39 years	2.552	36.277***	1.490	37.647***
	(10.019)	(9.108)	(12.185)	(12.472)
40-49 years	1.607	40.985***	3.491	43.397***
	(5.711)	(5.680)	(13.164)	(13.847)
50 and older	10.207	47.436***	7.463	46.716***
	(5.977)	(5.349)	(14.663)	(14.757)
Teaching 1 subject	5.178	-5.601	8.487	-4.805
	(7.010)	(5.960)	(9.313)	(7.769)
College degree	-10.233	10.716	-4.873	13.353*
	(6.615)	(7.017)	(9.707)	(10.015)
Additional Shift	9.847*	6.138	13.016**	7.510

Continued on next page

(*continued*)

Table **5**: **Regression Results of Average Spanish Test Scores**

Variable	**OLS**		**Heckman Estimation**	
	Morning Shift	**Afternoon Shift**	**Morning Shift**	**Afternoon Shift**
	(5.395)	(5.177)	(7.777)	(7.026)
Has Another Job	5.701	34.693***	12.398	37.744***
	(11.881)	(7.774)	(16.131)	(12.731)
School Characteristics				
Violence in vicinity	-14.228***	-9.664**	-11.710**	-9.153*
	(4.718)	(4.520)	(7.246)	(5.966)
Number of Books:				
100-200	-10.246	27.593***	2.855	30.054***
	(13.723)	(9.353)	(22.125)	(17.404)
200-400	-35.959***	13.532	-21.538	17.096*
	(8.347)	(7.206)	(21.029)	(14.907)
400 and more	-27.543**	20.051**	-15.179	23.135***
	(5.261)	(4.649)	(19.386)	(13.097)
Number of Computers:				
10 and less	12.779	-5.426	17.222	-2.893
	(9.673)	(8.796)	(15.192)	(14.726)
11-30	9.967	-7.999	13.824	-5.888
	(5.714)	(5.286)	(14.147)	(12.703)
31-50	18.468	-10.864	15.686	-12.586
	(7.424)	(6.858)	(17.351)	(16.083)
50 and more	15.239	29.925**	16.121	31.376**
	(7.666)	(9.093)	(16.648)	(20.252)
Disability Facility	-0.988	13.786*	-4.114	11.180
	(6.568)	(6.635)	(10.746)	(11.242)
Sport Facility	-2.575	-1.999	-4.445	-2.497
	(6.447)	(6.468)	(9.345)	(9.865)
Urban	1.603	-20.842*	12.562	-16.668
	(15.259)	(11.163)	(21.414)	(15.874)
Inverse Mills Ratio			-36.392	-22.970
			(25.232)	(18.939)
Constant	558.869***	547.570***	597.438***	604.146***
	(2.321)	(2.231)	(102.076)	(78.018)
N	1,308	1,224	1,308	1,224
Presudo R^2	0.221	0.231	0.223	0.232

Standard errors in parentheses are bootstrapped and clustered at school level.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table **6**: **Decomposition of Expected Math Score Gap**

	OLS Estimation		Heckman Estimation	
	Estimate	**Std. Error**	**Estimate**	**Std. Error**
Total	41.923***	2.138	41.923***	2.138
Explained	23.732***	1.209	35.601**	15.941
Student	13.876***	0.871	17.874***	5.219
Teacher	9.676***	0.873	16.820*	10.695
School	0.180	0.245	0.907	1.870
Unexplained	18.191***	4.870	2.162	33.220
Selection	–	–	4.160	18.481

Delta Method is used to get standard errors

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table **7**: **Decomposition of Expected Spanish Score Gap**

	OLS Estimation		Heckman Estimation	
	Estimate	**Std. Error**	**Estimate**	**Std. Error**
Total	45.727***	2.133	45.727***	2.133
Explained	17.553***	1.289	38.826**	16.809
Student	22.642***	0.877	30.683***	5.944
Teacher	-2.801***	1.024	9.404	11.350
School	-2.287***	0.220	-1.261	1.489
Unexplained	28.174***	4.434	-27.427	33.341
Selection	–	–	34.328	18.221

Delta Method is used to get standard errors

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$